TIME-SPACE REPRODUCTIVE DIFFERENCES OF BLACK HAKES, *M. polli* AND *M. senegalensis* OFF THE NW AFRICAN COAST

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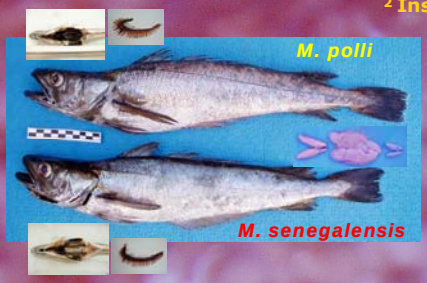

INTRODUCTION

Black hakes from NW Africa include two species, *Merluccius senegalensis* and *Merluccius polli*. Both species are target of commercial fisheries, especially by trawl fleets, and by longliners between the Western Sahara and Senegal, mainly in Mauritanian waters. Due to their great resemblance and their overlapped distribution, both species are recorded mixed in statistics, as well its gonad's landings, as *Merluccius* spp. (Hakes' female gonads are highly valuable for Spanish markets). *M.polli* is the predominant species of the trawling fleet catches (88%), whereas *M. senegalensis* is the most abundant species in the longline fishing area (67%) (Fernández *et al.*, 2006). Little information is available about the reproductive pattern of these species. The aim of this work is to analyze the temporal and spatial variation of black hakes during the spawning season and to estimate the reproductive period of this species.

METHODOLOGY

Monthly time series of female gonad landed in Cadiz harbour between 1984 and 2006, were splitted up in TREND and the SEASONAL components, using a X-12 ARIMA routine. Biological data of both species were collected by sampling stations on board commercial trawlers and during experimental longline's surveys in Mauritanian waters from 2003 to 2007. 12 surveys were carried out, in January (2), February (4), November (3) and December (3). The macroscopic gonadic stages were determined (maturity key of Lucio, *et al.*, 1998). 10,850 and 2,685 specimens of *M. polli* and *M. senegalensis*, respectively, were sampled. Average of mature females (spawning stage) by species has been integrated and geo-referenced; data have been analyzed by time-dependence, and geographical and bathymetric distribution. Sex-ratio were examined too.

RESULTS

Spawning period

The spawning took place during the cold season, from November to February with the strongest signal during December-January for both species (Fig.1). The seasonal component of the time series is very strong, whereas the trend did not show a clear pattern.

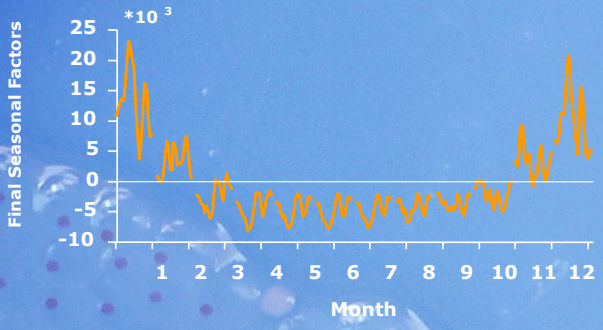

Figure 1 . Seasonality of monthly females gonad landings (1984-2006).

Spawning areas

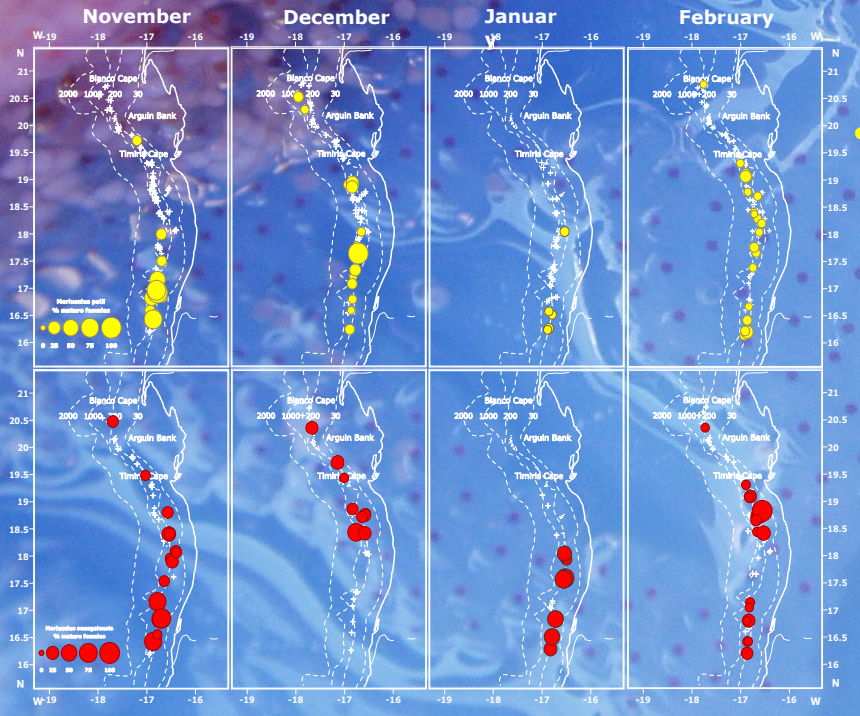

Figure 2. Percentage of mature females spawning in the study zone.

- *M. polli* → deeper hake (200-1000 m) and wide geographic distribution (25ºN-18,5ºS): The spawning females were located mainly southward of 17,5ºN (peak between 16º-17ºN). November-December were the main spawning months. In February, increased their distribution, till Cape Timiris (19,5ºN), but the proportion decreased (Fig.2). Concentrated mainly at 500-800 m, however with certain important spots at 200-500 m (Fig. 3).

- *M. senegalensis* → shallower hake (100-500 m) and restricted geographic distribution (33ºN-12,25ºN):

The spawning females distributed between 19,5º and 16ºN, with two groups, southward Cape Timiris (Dec-Feb) and around 17ºN (Nov). The spawning season seems to be widely (Fig. 2). Spawning females are present between 100-500 m, exceptionally, at more 500 m depth (Fig. 3).

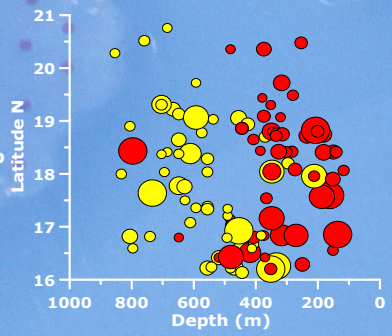

Figure 3. Distribution % mature females in latitude and depth (12 surveys).

Sex-ratio

Note the high females proportion of both species (*M. polli* 1:4.3, *M. senegalensis* 1:2.5) in the whole study zone (cold season). In general, we observed an increase in males proportion in those sampling station dominated by female in spawning condition, *M. polli*, southward (16º-17ºN) and *M.senegalensis* in the central zone (17º-19ºN) (Fig. 4).

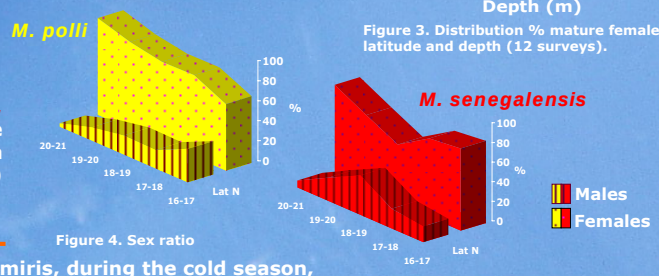

Figure 4. Sex ratio

Spawning ground of both hake species seems to be located southward Cape Timiris, during the cold season, avoiding the permanent upwelling off Cape Blanc. In spite of both species shared their distribution area and a depth belt (between 100 - 500 m), they were not caught in the same sampling stations regularly, which implies a not simultaneous spawning. The increasing of male's proportion in the concentration's zones of spawning females is a behavior already observed in some other hakes (Di Giacomo *et al.*, 1993; Pájaro *et al.*, 2005). *M. senegalensis* seems to have a spawning season more prolonged. However, because the wide distribution of *M. polli* the spawning ground could be extended southward, out of the study zone, where is just suggested a spawning area of this species (Garcia, 1982). The observed bathymetric in the mature specimens of both species are related to their habitats and do not hinder considering the black hake fishery as a single-species entity for stock assessment and management purposes.

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